Statement of

## James M. Beggs Administrator

### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Committee on Science and Technology
House of Representatives

Mr. Chairman and Members of the Committee:

It is a pleasure for me to appear before this distinguished Committee to present President Reagan's budget request for NASA for Fiscal Year 1984. The total request is \$7.1 billion, of which \$5.7 billion is for Research and Development, \$150 million for Construction of Facilities, and \$1.25 billion for Research and Program Management. A chart summarizing NASA's FY 1984 request is appended to this statement.

I am particularly proud to be at NASA in 1983 to celebrate its 25th Anniversary. During the 25 years since the United States entered the Space Age, our space program has grown from the 14 kg Explorer, launched in January 1958, to a truly reusable Space Transportation System.

With your permission, Mr. Chairman, I would like to spend a few minutes discussing some of the achievements of the past year -- achievements which have been very significant, indeed, and which would not have been possible without the strong and continued support of the Congress. In 1982, the Space Shuttle Orbiter Columbia made three successful orbital flights and, during each flight, significant progress was made in understanding the operational features of the Shuttle This initial phase of the STS flight program culminated with the first operational flight in November 1982, during which two commercial communications satellites were launched. There is no doubt in my mind, Mr. Chairman, that the investment this Nation has made in the Space Shuttle will pay off handsomely. We now know enough about the system so that I can make this statement with great confidence.

As you know, a new earth observation satellite, Landsat 4, was placed in earth orbit in July 1982, and its operations have been spectacularly successful. The satellite's new thematic mapper has provided information of a quality exceeding the original specifications; it is providing valuable information for the geophysical sciences as well as excellent data for mapping and earth resources assessment. Additionally, our earth orbiting scientific satellites and other spacecraft in the solar system have continued to operate and to return extremely valuable scientific information.

In aeronautics, the Department of Defense has recognized the importance of NASA's technical contributions by considering NASA's tilt-rotor aircraft concept as a prime contender for the new joint service JVX vertical take-off and landing aircraft program. XV-15 experimental aircraft, jointly developed by the Army and NASA, served as the proof-of-concept vehicle which made this recognition possible. Two large new aeronautical facilities are nearing completion, the National Transonic Facility at Langley Research Center and the new 80x120 foot addition to the 40x80 foot Subsonic Wind Tunnel at Ames Research Center. completion of operational test and checkout of the new 80x120 foot leg has recently suffered a set-back because of an accident during testing. The facility is expected to be operational in about two years. NASA hopes to repair the facility and return it to operation as soon as possible to minimize delays to a number of priority NASA, DOD, and industry testing programs.

This is just a brief overview of some of the technical achievements of 1982--the list is really much longer. I will talk in more detail about some of the things that have been accomplished later on.

I would now like to turn to another achievement, a renewed commitment to the American space program from the highest levels of this Administration. On July 4, 1982, President Reagan issued a policy statement which outlines basic U.S. goals for activities in space. These goals are:

- o to strengthen the security of the United States;
- o to maintain United States space leadership;
- o to obtain economical and scientific benefits through the exploitation of space;
- o to expand United States private sector investment and involvement in civil space and space related activities;
- o to promote international cooperative activities in the national interest; and, finally,

o to cooperate with other nations in maintaining freedom of space for activities which enhance the security and welfare of mankind.

The NASA budget request for FY 1984, which I am addressing today, is designed to achieve the objectives outlined in President Reagan's space policy--especially the maintenance of United States leadership in space. This is really the important word--leader-ship--and this Committee may rest assured that the Administration is strongly committed to what that word represents.

The key to leadership in space is to have efficient and effective ways of getting there. The President's space policy strongly supports the Space Shuttle program, and calls the Shuttle "the primary space launch system for both United States national security and civil government missions."

NASA's proposed FY 1984 budget fully supports a four-orbiter fleet, with enough structural and subsystem spares to make certain that the fleet is able to survive serious delays or accidents. Our proposal will also reduce the lead time for expansion or replacement of the four-orbiter fleet, if and when operational demands require. Our plans make it possible to meet the commitment to launch the payloads which we, and those depending upon us, have planned for at least the remainder of this decade. NASA's first priority, Mr. Chairman, remains: to make the Space Shuttle System fully operational as rapidly as possible. Additionally, we will continue to explore new ways of employing the full capability of the Shuttle. The proposed FY 1984 request continues funding of activities leading to a Shuttle mission to recover and repair on orbit the partially defunct Solar Maximum Mission (SMM) spacecraft in 1984. This will provide more useful life for the important SMM objectives and demonstrate the Shuttle's ability to perform such operations. Later on this year, we are scheduled to fly the first Spacelab mission which is an important demonstration of the new capabilities represented by the Space Shuttle. Spacelab, developed and contributed by the European Space Agency, represents an important international activity consistent with the President's space policy.

Another international contribution to the Space Shuttle Program is the Remote Manipulator System (RMS) which was provided by the Government of Canada. The RMS successfully completed testing last year and in November was declared ready for operational use aboard future Shuttle flights.

NASA policy has recently been revised to expand opportunities for sponsors of Shuttle payloads to nominate payload specialists to fly with them. President Reagan invited a Brazilian payload specialist to fly aboard the Shuttle, and during his recent discussions with the Prime Minister of Japan, he extended a similar offer which was accepted. Australia and Canada have also accepted invitations for payload specialist nominations.

The second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE '82), held in Vienna last August, helped to promote greater international awareness of the practical benefits of the applications of space science and technology.

In my testimony before this Committee last year, I said that the Space Telescope will be the most important scientific instrument we have ever flown. I continue to believe this is true, and NASA's FY 1984 budget request provides priority support to this very important development effort.

As might be expected in a program of this complexity, we are continuing to experience technical problems, particularly in the Optical Telescope Assembly development activities, which will most likely impact the scheduled launch and runout cost of the Space Telescope. We are currently reviewing a range of alternatives for rephasing the work to minimize the cost and schedule impact. As soon as our evaluation is complete, we will inform the Committee of our proposed actions.

Excellent progress is being made in other areas related to the Space Telescope. In a few months, we will open the doors of the new Space Telescope Science Institute which has been established at the Johns Hopkins University. Software and procedures for carrying out scientific investigations with this very complex space observatory are on schedule. The Space Telescope will open a new era of scientific opportunity and permit the U.S. to retain world leadership in astronomy.

Another measure of leadership in space is the continuing enterprise of planetary exploration. We have included in the proposed FY 1984 budget the initiation of a new program to map the surface of the planet Venus using radar imaging techniques. Within our overall strategy for planetary exploration, this initiative — the Venus Radar Mapper (VRM), estimated to

cost in the \$350 million range -- replaces, at a much lower cost, the Venus Orbiting Imaging Radar (VOIR) mission authorized by the Congress to begin in FY 1982. The VRM mission will help us understand why our sister planet, Venus, which is so much like the earth in size and physical composition, yet so different in other respects, has followed such a different evolutionary history. We will search for detailed properties in common with the earth, such as volcanic activity and continental drift. Aside from their intrinsic scientific value, observations provided by the VRM will help us to understand more clearly the history, nature, and most importantly, the future of our own planet.

The Advanced Communications Technology Satellite (ACTS) project, another new initiative proposed in the FY 1984 budget, calls for development and flight testing of the high-risk technology needed to ensure continued United States preeminence in the field of satellite communications. The decision to propose the ACTS program is a result of extensive consultation with communication carriers, satellite system suppliers, and strong support from the Congress. The ACTS program will involve a novel procurement approach, including a cost/risk sharing arrangement with industry which will provide significant cost savings to the government.

Another goal of the President's space policy is to expand private sector investment and involvement in space activities. NASA has received proposals from the private sector to fund and/or operate launch vehicles. We are reviewing these proposals very carefully to determine costs and benefits, launch and tracking requirements, safety and security, as well as international considerations.

In addition to the President's space policy which I have already discussed, the Administration has developed a new policy statement governing the needs for and management of Federally funded research and development work in aeronautics. In November 1982, the President's Office of Science and Technology Policy released a document entitled, "Aeronautical Research and Technology Policy." The aeronautics program included in NASA's FY 1984 budget request reflects many recommenda-

tions contained in this important policy statement. The most important facet of the Administration's new aeronautics policy is the recognition that a strong aeronautical industry is absolutely essential for both the National security and the health of our economy. Furthermore, this policy recognizes explicitly the important role the Federal Government, through NASA, plays in providing the basic technology which will assist the United States in maintaining and enhancing the leading position in aviation which we now enjoy. In concert with this policy, we are submitting an FY 1984 budget request which continues to emphasize a strong aeronautical research and technology program, including a strengthened fundamental research program which will continue to provide the technical base upon which future aircraft designs can be based.

The centerpiece of our proposed aeronautics program for FY 1984 is the new Numerical Aerodynamic Simulation (NAS) activity, which will be developed over the course of the next few years. The NAS capability will include a large computer system which will make it possible to perform most of the calculations required to design a new aircraft with sufficient accuracy and reliability to significantly reduce the long and expensive process of wind tunnel and flight testing now There is every reason to believe that the computer technology to achieve this objective can be developed in the next few years, and there is no question that the capability the NAS represents will make it possible to design new airplanes much more effec-The investment made in NAS will provide incentives for various elements of the computer industry to produce machines which will be able to take advantage of major commercial applications. Developments of this kind will enhance the competitive posture of the United States in this important international market.

The FY 1984 budget proposed by the Administration also contains a number of items which are very important to the future of NASA's health as an institution. It is clear that the achievements I have outlined earlier in my testimony would not have been possible without a strong NASA institution. In the FY 1984 budget before you, there is a substantial increase in

funding for Construction of Facilities—\$150 million as compared to approximately \$100 million in FY 1983. We are also proposing the maintenance of the same number of civil service positions in FY 1984 as we have in FY 1983. The maintenance of our civil service strength is particularly significant because this manpower level will afford an opportunity for NASA to hire some of the best recent graduates of the foremost science and engineering schools in the Nation. We plan to take aggressive steps to bring in the best people we can find in order to strengthen NASA's institution for the long term.

In the past year, Mr. Chairman, concern has been expressed in the press and in the Congress about the appropriate relationship between NASA and those elements of the National security establishment with responsibility for space operations. I would like to take this opportunity to state categorically that this Administration is strongly committed to separate space programs, one dealing with civil sector operations and the other with those related to the National security. The President's space policy is very clear on this point, stating that, "The United States space program will be comprised of two separate, distinct, and strongly interacting programs--National security and civil. Close coordination, cooperation, and information exchange will be maintained among these programs to avoid unnecessary duplication." We have continued to maintain separate programs and to have separate policies governing these programs; but we have also developed a number of new interactive relationships which promote efficient coordination and management while protecting the integrity of NASA programs. We have just finalized a renegotiated Shuttle pricing agreement with the Department of Defense. This new agreement will provide NASA with increased reimbursements of approximately \$1 billion more in the next five years than the Agency would have received under the previous policy agreed to in 1977. This revised policy will raise the Shuttle launch cost to DOD by almost 150 percent, in FY 1975 dollars, above the previously set launch price. We also have several Memoranda of Understanding with the Department of Defense which deal with various aspects of programs in order to avoid the

unnecessary duplication which the President mentions in his space policy.

I would be remiss, Mr. Chairman, if I did not conclude this portion of my testimony by talking about the future. The President's space policy recognizes the importance of developing new concepts which provide a strong vision of the future, not only for our space program, but for the Nation as a whole. In his space policy, the President requires NASA to "continue to explore the requirements, operational concepts, and technology associated with permanent space facilities." The Space Shuttle makes it easier to establish larger permanent facilities in space. NASA's proposed FY 1984 budget includes modest funding for definition and planning efforts which will allow us to understand, in greater detail, how such permanent facilities might be developed and maintained in earth orbit. These studies will provide a basis for considering possible future proposals to establish a permanent manned station in earth orbit.

I should stress that we are not now proposing to develop such a space station, but we believe that it is important to understand the uses to which such a capability could be put. We have every reason to believe, Mr. Chairman, that the Soviet Union has learned a good deal about manned operations in space from their experiences with Salyut 6 and Salyut 7. There is also evidence that the Soviets are planning more extensive activities in earth orbit, and we must understand potential benefits of such operations. It is important for the United States to take the necessary steps now to achieve these objectives.

Mr. Chairman, having discussed some of the important highlights, I would now like to proceed with a more detailed discussion of NASA's proposed FY 1984 program.

## SPACE TRANSPORTATION

For FY 1984, the Space Transportation request is \$3.498 billion. This includes \$1.927 billion for Space Transportation Capability Development and \$1.571 billion for Space Transportation Operations.

Since the budget hearings of last year the Space Transportation System has continued to mature. The Space Shuttle Orbiter Columbia made three flights in 1982, completing the Orbital Flight Test Program and initiating the transition into a fully operational system. STS-3 carried the first space science pallet of instruments and demonstrated the practical use of STS-4 carried the the Remote Manipulator System. first DOD payload; and STS-5, the first operational flight, demonstrated a number of "firsts." It was the first time the Shuttle's main engines were run above their rated power level (100 percent) during ascent; the first four man crew; and the first launch of commercial payloads, Telesat-E and SBS-C. STS-5 also carried a getaway canister, four student experiments and a joint endeavor experiment with McDonnell Douglas Corporation, to investigate the commercial potential of separating biological materials in space using a continous flow electrophoresis device. The success of the STS-5 contributed immensely to our image of having an operational system and demonstrated our ability to deliver commercial payloads.

We had planned to launch STS-6, the first flight of our second orbiter, Challenger, later this month. We have completed a first flight readiness firing on the Challenger main propulsion system in December, and found higher concentrations of gaseous hydrogen in the aft fuselage than we found on the flight readiness firing of the Comumbia. We repeated the Challenger flight readiness firing on January 25 with extensive instrumentation. This test confirmed, and we have now located, an elusive internal hydrogen leak. The tests also validated very low levels of oxygen in the aft fuselage. The leak was found on engine number one and this engine is being replaced with a flight spare engine. We should be able to proceed with STS-6 in March and to minimize our delay for subsequent flights. Additionally, we are developing operational tests and procedures to insure that future flights will not be subject to this type of delay.

The Space Transportation Capability Development Program provides for the National fleet of Space Shuttle orbiters, including main engines, and provides for the launch site and mission operations control requirements, initial spares, production tooling and related

activities to meet the needs of NASA, the DOD, and other domestic and international users of space. In addition, this program includes upper stages, Spacelab and advanced programs requirements. In 1983, the third orbiter OV-103, will be delivered for the first operational flight in early 1984. The FY 1984 budget will also allow for completion of the final assembly and integrated testing of OV-104, leading to a delivery at the end of 1984, and the acquisition or orbiter structural spares to support the existing orbiter fleet.

The FY 1984 budget will extend the Shuttle processing and launch capability with the continuing preparations for activating the second launch pad, initial construction funds for the third mobile launcher platform, and modifications to Pads-A and-B to make them Centaur-compatible.

In the upper stages programs, funds are requested to continue the development of Centaur-G, in cooperation with DOD, and Centaur-G prime to support the Galileo and ISPM launches in 1986. We also plan to use the Centaur-G to launch the Venus Radar Mapper in 1988. The budget allows for completion of the IUS vehicles to support four planned TDRSS launches.

The first Spacelab flight is scheduled for 1983. FY 1984 funds will support post-flight data analysis, and integration and checkout for the second Spacelab verification flight scheduled for FY 1985. Funding is also provided for payload support to the Spacelab 2 and Spacelab 3 missions, Galileo, ISPM, Space Telescope, and the SMM retrieval/repair mission.

In FY 1984, the major emphasis in Space
Transportation advanced programs will be to define the
system architecture and system elements for possible
space operations over the next 20 years. Funding will
provide for studies of earth-orbital platforms and
facilities; orbital services such as satellite servicing; and advanced transportation concepts for reusable
upper stages, teleoperated maneuvering vehicles and
Shuttle derived Earth-to-orbit launch vehicle systems.
FY 1984 funding will also provide for the initiation of
hardware development of the Tethered Satellite System,
a cooperative project with Italy. The Italians will
develop the spacecraft and the U.S. will develop the
deployment mechanisms and will be responsible for the
program management and integration with the orbiter.

The Space Transportation Operations Program provides the standard operational support services for both of the primary U.S. government space launch systems — the Space Shuttle and the expendable launch vehicles. The budget for FY 1984 will provide for production of Shuttle flight hardware (external tanks, solid rocket boosters, engine spares and orbiter spares); maintenance and operation of mission control and crew training systems; and the manpower necessary to support the launches planned for FY 1984. Ten sets of SRB hardware and 11 external tanks are scheduled for delivery in FY 1984.

In November, we awarded a base operations contract for NASA's Kennedy Space Center, to EG&G, Inc., aimed at strengthening support of our launch functions. Under this contract, there will be a clear assignment of responsibility and accountability and a reduction of management interfaces from fourteen to one. In late 1983, we expect to award a Shuttle processing contract which will further reduce the program management complexity and operational costs. The initial start up costs and projected manpower savings are reflected in the FY 1984 estimates. Later, we hope to issue a cargo processing contract to complete the consolidation of our efforts.

We have also taken steps to reduce production costs and increase launch capability. A significant milestone was reached last September when we took delivery of the first lightweight external tank five days ahead of a schedule set in 1980. Our goal was to reduce 6,000 pounds from the previous tank configuration and we actually achieved a 10,000 pound reduction. An additional improvement in payload capability of approximately 5,500 pounds is expected from the new filament wound case, for the solid rocket booster, which is planned for first use in late 1985. Programs are also underway to reduce recurring external tank and solid rocket booster production costs, include modification to the aft skirt structure, modifications in applying and removing tank TPS and development, of low cost solid rocket motor nozzle material.

In the Expendable Launch Vehicles program, the FY 1984 funding reflects the requirements to support the Delta launch vehicle's missions. We have recently

determined that the number of vehicles to be procured for non-NASA missions should be reduced commensurate with the revised reimbursable launch requirements. The Delta system is planned to be operational at least until 1986 to support the launch requirements of the National Oceanic and Atmospheric Administration.

## SPACE STATION PLANNING ACTIVITIES

Last May, I established a Space Station Task Force to provide focus and direction to the Agency's planning activities for this potential major new initiative. The planning effort will be continued and expanded modestly in FY 1984 in order to generate the information, including costs and benefits, necessary for the Administration and Congress to make an informed decision on whether to proceed with some form of more permanent space facilities.

NASA's FY 1983 planning activity is focused upon understanding exactly what a space station could do, emphasizing the several areas of endeavor that utilize space: science, applications, technology development, National security, and commerce. We have deliberately steered away from design and configuration, directing our attention, and that of other interested parties, than to mission requirements and "architecture." Our goal is to have a thorough understanding of space station functions and the consequent attributes a station would require to carry out specific missions. Last summer, we sponsored eight small industry studies of potential space station missions. These are on schedule and will be completed shortly. Their results will be synthesized into potential time-phased mission sets which could be accomplished by a station in space. In addition, we have held discussions with our scientific and technical advisory committees, potential international partners and the Department of Defense to encourage them to review space station missions.

NASA's FY 1984 request includes \$6 million within Space Transportation Advanced Programs which will be used primarily for space station systems engineering activities. An additional \$6 million is included to augment on-going efforts in the FY 1984 Space Research and Technology program, principally to focus on key technology activities. In addition, \$2 million is

requested in the Space Science and Applications program primarily for studies of science and applications payloads applicable to a space station. FY 1984 planning calls for identification of an "architecture" which could accommodate a preferred mission set, and further refinement of conceptual approaches.

## SPACE SCIENCE AND APPLICATIONS

The past year's highlights for the Space Science and Applications program, in addition to the Landsat 4 launch, include the recent launch of the Infrared Astronomy Satellite (IRAS), and the outstanding early success of the Search and Rescue Satellite project.

Landsat 4 was launched in July, to provide more sophisticated and reliable data on earth resources. Landsat 4 carries a flight-proven Multispectral Scanner (MSS) and Thematic Mapper (TM) instruments for remote sensing. Data from these instruments have surpassed all expectations. The improved ground resolution and extended spectral range provided by the Thematic Mapper will enable users to recognize subtle differences in forest species, agricultural conditions, soil moisture and water turbidity that could not be detected in earlier MSS imaging. Approximately 4,000 TM scenes of the continental United States have already been acquired and archived during the first six months of Landsat 4 operations, and several research programs are now underway to evaluate in detail the quality and scientific utility of the Landsat 4 imagery.

IRAS, an extremely difficult and technologically challenging mission, developed in cooperation with the Netherlands and the United Kingdom, will execute the first comprehensive survey of the infrared sky, providing a new window to the universe. It is expected to revolutionize astronomy in the same way that the first ultraviolet and x-ray satellites did in the last two decades.

The Search and Rescue Satellite project, another significant international cooperative endeavor, began system checkout in September, and demonstrated its effectiveness almost immediately when a small aircraft which had crashed in a remote region in British Columbia was detected by the system. The injured pilot and two passengers were rescued. By mid-November, the new system was directly credited with saving ten lives in aircraft and marine accidents.

Our FY 1984 budget request of \$1068.0 million for Space Science and Applications supports the two new

initiatives I mentioned earlier -- the Venus Radar Mapper and the Advanced Communications Technology Satellite -- and will enable us to pursue a vigorous program. The proposed budget supports the completion of the Landsat-D' spacecraft; it continues the Space Telescope development leading to a launch in 1985; it continues Galileo development leading to a single Shuttle/Centaur launch in 1986; and it continues International Solar Polar Mission (ISPM) instrument development support leading toward launch in 1986. It continues the hardware development of the Gamma Ray Observatory (GRO) leading toward a planned launch in 1988. supports a 1984 launch for the Earth Radiation Budget Experiment (ERBE); technology development and analysis of flight experiments in Materials Processing; operation of the Pioneer Venus Orbiter, Pioneers 6 through 11, and Voyagers 1 and 2; support for the Infrared Telescope Facility and the Lunar Curatorial Facility; and continued development of experiments to understand the effects of weightlessness on man.

The Explorer development funding level is somewhat higher than in FY 1983 because this program offers important opportunities to address key space science questions in a highly cost effective manner. This level of FY 1984 funds will allow us to complete development of the Active Magnetospheric Particle Tracer Explorer (AMPTE), a project to determine how particles from the solar wind enter the Earth's magnetosphere; will support development activities for the Cosmic Background Explorer (COBE) satellite. The FY 1984 program will support initiation of the Extreme Ultraviolet Explorer (EUVE), which is expected to reveal new information on the structure and composition of interstellar media.

This proposed Space Science and Applications budget represents a commitment to maintain the momentum in scientific and technical excellence that has had such an important impact on the Nation and the world. It will continue the outstanding effort of the past, initiate new activities, and assure the preservation of the scientific research base that is critical to United States leadership in space.

## TECHNOLOGY UTILIZATION

For FY 1984, we are requesting \$4 million for Technology Utilization to continue the transfer of NASA-developed technology to U.S. industry, the public and other Government agencies. We have two primary program objectives: 1) to target applications engineering efforts to increase productivity in U.S. manufacturing industries, and 2) to improve the quality of

life and workforce through bioengineering and rehabilitation projects. We intend to enhance public sector technology applications projects in conjunction with other mission-oriented Federal agencies and industry with a view toward shifting budgetary responsibility for resultant projects to those entities.

## AERONAUTICAL RESEARCH AND TECHNOLOGY

In FY 1984, a total of \$300.3 million is requested for NASA's Research and Technology program, to provide the technology advances essential to the continued U.S. leadership in aeronautics. A strong base of technology is needed to develop future U.S. aircraft which will enhance our competitive position in the world aviation marketplace, and to provide continued superiority of the Nation's military aircraft. NASA's FY 1984 budget request continues to emphasize a strong fundamental research and technology base of activities as well as focused systems research activities, and constitutes a balanced effort in response to the Administration's recently enunciated aeronautics policy.

In FY 1984, emphasis in fluid and thermal physics will be applied to turbulent drag reduction, internal computational fluid dynamics, and high Reynolds number cryogenic testing to be provided by the National Transonic Facility at NASA'S Langley Research Center. This facility, which will become operational in June 1983, will provide the most advanced transonic speed test capability in the world. Using models of the world's most advanced aircraft, this facility will allow near exact simulation of flight conditions. Areas of emphasis in materials and structures will include ceramics, new composite materials, and transport crash dynamics. In controls and human factors, new research capabilities will be provided by the Man-Vehicle Systems Research Facility at the Ames Research Center and the Avionics Integration Research Laboratory at the Langley Research Center. The upgrading of capabilities in computer science and applications will continue to receive major emphasis, with expanded efforts directed toward technology for fault tolerant systems. In propulsion, emphasis will be placed on intermittent combustion engines, helicopter and turboprop transmissions, engine dynamics and stall recovery, and small radial turbomachinery. Rotorcraft research will stress noise and vibration reduction and the unsteady aerodynamics of rotors. Research will also be conducted to investigate guidance and control for all-weather rotorcraft operations, composite tilt rotor blades and technologies aimed at improving performance and flying qualities of the tilt rotor vehi-

cle class. Areas of emphasis in high-performance aircraft research will include supersonic cruise technology, hypersonic propulsion, structures, configuration aerodynamics, and propulsion/airframe integra-Also included will be flight evaluations of advanced concepts using special F-16 and F-111 aircraft to investigate new technologies for enhancement of fighter performance. The proof-of-concept flight research phase of the NASA/Defense Advanced Research Projects Agency (DARPA) X-29A forward swept wing vehicle will begin, and increased effort will be provided in the Turbine Engine Hot Section Technology program to study means for increasing engine performance and durability. In subsonic aircraft, research emphasis will be placed on commuter aircraft technology, icing and lightning research, natural laminar flow, and problem areas identified in coordination with the Federal Aviation Administration as critical to improved air safety and operations.

In FY 1984, program augmentations are planned in the important long-lead, high-risk technology areas: numerical aerodynamic simulation, large composite structures, and rotorcraft. The Numerical Aerodynamic Simulation initiative will significantly augment the Nation's program in computational fluid dynamics and other areas of computational physics. It will provide advanced capability for users nationwide for computational aerodynamics, computational chemistry, and other complex analytical problems. Advanced composite structures technology will address thick, load-critical primary structures representative of large aircraft wing-structure sections; curved panels to investigate fuselage design technology problems; and new generation materials for increased toughness and impact resist-Technology for next-generation rotorcraft will pursue further understanding relative to two high-speed rotorcraft concepts -- the advanced tilt rotor technology and the DARPA X-wing utilizing NASA's Rotor Systems Research Aircraft.

## SPACE RESEARCH AND TECHNOLOGY

NASA's FY 1984 Space Research and Technology request of \$138 million will focus on providing advanced technology in support of NASA's role of maintaining the U.S. preeminence in space. This investment in research and technology is essential for improving operational capability, reliability, and affordability of existing and planned NASA missions, as well as providing the technology base and technology options for rapidly expanding military and commercial space interests.

The FY 1984 budget continues to emphasize a strong Research and Technology (R&T) base of activities in the discipline areas of fluid and thermal physics, chemical propulsion, materials and structures, computer science and electronics, space energy conversion, controls and human factors, and space data and communications. computer science and space human factors disciplinary activities represent new elements in the R&T base that respond to important future systems needs, as well as to identifiable, high-leverage, technological advancements. In addition, activities in spacecraft, transportation, and platform systems research are designed to study the inter-relationships of discipline technology from an integrated systems point of view. These efforts are critical to the successful transition of technology from the laboratory to useful application. In FY 1984, a modest expansion to the base program in platform systems is planned to investigate technology options that could enhance capabilities and growth potential of permanent space facilities.

The Systems Technology effort in FY 1984 will focus on the following technology missions or experiments: launch of the long-duration exposure facility, the solar array flight experiment, solar cell calibration facility, tribology experiment, reflight of the feature identification and location experiment, launch of the ion auxiliary propulsion system, design activity on a space technology experiment platform, and a cryogenic fluid management facility.

### ENERGY TECHNOLOGY

During the past year, NASA has continued to support the Department of Energy (DOE) and other agencies in energy research and technology development. Important progress was made by NASA's Lewis Research Center in advancing ceramic component technology for the automotive gas turbine, and in improving the life and performance of advanced phosphoric acid fuel cell systems.

In FY 1984, NASA will continue to support those energy programs which were initiated in prior years, and which the DOE or other sponsoring agencies desire NASA to continue. We intend to complete our previous commitments as efficiently as possible to ensure the integrity of the government investment made to date. For the future, it will be our policy to concentrate on energy programs which have objectives which are synergistic with NASA's aeronautics and space programs.

## SPACE TRACKING AND DATA SYSTEMS

For the Space Tracking and Data Systems program in FY 1984, NASA is requesting a total of \$700.2 million, which includes \$294.7 million for acquisition of service via the Tracking and Data Relay Satellite System (TDRSS) as well as support of TDRSS related elements. This request provides for the continuation of the vital tracking, command telemetry and data acquisition support to meet the requirements for all NASA flight programs.

The Spaceflight Tracking and Data Network (STDN) and the Deep Space Network (DSN) will continue to provide support to both near-Earth orbiting satellites, including the Space Shuttle operational flights and deep space probes. In FY 1984, numerous applications and scientific Earth-orbiting and planetary missions will be supported.

The launch of the first and second TDRS spacecraft are scheduled to be launched in 1983. The TDRSS is planned for full operational capability in 1984. TDRSS service contract has been restructured to convert the TDRSS from a shared system providing both support of government space missions and commercial communications satellite services, to a system dedicated to providing support to space missions. The FY 1984 budget request reflects the initial full year funding requirements for TDRSS service and the phaseout of most of the STDN ground stations after TDRSS is operational. Ground stations planned to be closed during FY 1984 are Guam, Hawaii, Ascension, Santiago, Dakar, and Botswana, with termination of STS VHF voice communications from Yarragadee, Australia, and the AF Indian Ocean site. The remaining facilities will then be consolidated with the DSN stations under management of the Jet Propulsion Laboratory (JPL), or dedicated to support of launch and landing operations. consolidation will result in a single ground network to support geosynchronous, highly elliptical, and all planetary missions.

### CONSTRUCTION OF FACILITIES

The Construction of Facilities (CoF) request for FY 1984 totals \$150.5 million. Slightly over one-third of the request, \$53.3 million, is required for Space Shuttle and payload facilities. The request includes \$24 million for aeronautics and space technology activities and \$58 million for repair, rehabilitation and modification, minor construction, and facility planning and design. The FY 1984 CoF request strikes an appropriate balance between NASA's need to meet increasing Shuttle flight rates, improve Shuttle manufacturing and processing efficiencies, provide enhance-

ments of existing facilities to afford improved research and testing capabilities, and to repair and preserve our present physical plant.

The Space Shuttle CoF projects are in direct support of achieving a 24-flight-per-year capability. Based on the experience to date, it is NASA's current assessment that two Mobile Launcher Platforms (MLP'S) can support up to 16 flights per year. Thus, the project for modifying a third mobile launcher platform for Shuttle use, at a cost of \$27.3 million, is required to reach 24 flights per year from NASA's Kennedy Space Center (KSC). The other large Shuttle- related projects reflected in the request are the construction of a Cargo Hazardous Processing Facility at KSC (\$9 million), and some additional modifications to the External Tank (ET) manufacturing facilities (\$11.7 million) at the Michoud Assembly Facility in New Orleans.

In the non-Space Shuttle area, our FY 1984 construction request is similar to those of recent years, providing for prudent investments necessary to preserve and improve existing research facility capabilities. An example is the Small Engine Component Testing Facility proposed for construction at NASA's Lewis Research Center. Modification of test cells in the Engine Research Building at LeRC are necessary in order that a critical need for testing and development of small turbine engines can be met. This project is typical of our continuing emphasis on modifying and improving existing facilities to meet new research and technology needs of the country.

Of equal importance is the \$58 million requested in FY 1984 for minor facility projects. These are critical to the repair and preservation of an aging physical plant and to ensure that NASA's facilities are capable of meeting today's technology needs.

## RESEARCH AND PROGRAM MANAGEMENT

The Research and Program Management request for FY 1984 is \$1,247.5 million. About three-fourths of this required for civil service salaries and related costs. About two percent is for travel which is vital to the management of our R&D programs. The belance is for facility support and related goods and services necessary for the operation of NASA Centers.

The FY 1984 plan provides for a NASA civil service workforce at approximately the present level, the first time in several years that we have not been planning to accomplish some kind of personnel reduction in the

current and budget years. Staffing stability of this kind is important for an R&D organization such as NASA. It allows us the opportunity to hire new scientists and engineers to assure the vitality of our technical workforce. It will also enable us to solve minor skill-mix problems that arose in previous years when we were faced with accommodating ceiling reductions. In FY 1983 and 1984 we will be able to plan our hiring in a more effective manner. Although I believe that NASA's workforce is one of the strongest and most creative in the world, we need the influx of people with new viewpoints, different skills, and knowledge of the latest technology in many diverse areas to maintain and improve this outstanding national asset.

The requested R&PM funds will provide for essentially the same level of operations in FY 1984 as planned in FY 1983, considering estimated price levels which are expected to rise at a significantly slower rate than we have experienced in the past years.

As you are aware, the President is very interested in increasing the productivity and improving the quality of all governmental activities. In order to provide leadership in this area and to provide coordination for the many productivity-related activities in both Headquarters and at the Centers, I have formed a steering committee composed of the top management officials of the Agency. The steering Committee is focusing on our overall goals of (1) maintaining NASA as a leader in the development and application of advanced technology and management practices which contribute to significant increases in both Agency and National productivity and quality; (2) identifying areas where NASA practice is behind the state-of-the-art in productivity and quality and to initiate actions to effect improvement; and (3) enhancing awareness among management, the workforce and our contractors of the need to achieve increases in our productivity. We are already moving on some specific productivity initiatives in reducing paperwork throughout the Agency, in introducing common and shared administrative automatic data processing systems and coordinating an Agency-wide plan for information through office automation.

Finally, I am pleased to point out that, even with the significant civil service personnel reductions in FY 1982, we were able to improve the ratio of minority and female professional employees in the NASA workforce. Last year the ratio of minority professionals in the workforce rose from 8.4 percent to 8.7 percent, and for females in professional position from 11.6 percent to 12.2 percent. Consequently, minority and female professionals now make-up 19 percent of

NASA's professional workforce and 28.7 percent of the total workforce.

## CONCLUSION

In conclusion, Mr. Chairman, I believe that NASA's FY 1984 budget request represents a well-balanced program which fully funds the Space Transportation efforts, provides for continuing programs in Science, Applications, and Aeronautics, and reflects several important new Research and Development initiatives. This request also reflects, significantly, an augmented Construction of Facilities program, and a stabilized NASA civil service workforce level. I trust that the Committee will recognize this as a balanced and healthy proposal, which reflects the Administration's commitment to a vital U.S. civilian space program, and that the Committee will fully support NASA's proposed FY 1984 budget.

## National Aeronautics and Space Administration

## BUDGET SUMMARY

(thousands of dollars)

	Budget Plan		
	1982	1983	1984
RESEARCH AND DEVELOPMENT			
Space Transportation Systems	3,089,900	3,597,800	3,498,000
Space Science and Applications	896,200	1,034,100	1,068,000
Technology Utilization	8,000	9,000	4,000
Aeronautical Research and Technology	264,800	280,000	300,300
Space Research and Technology	111,000	123,000	138,000
Tracking and Data Acquisition	402,100	498,900	700,200
Total Research and Development	4,772,000	5,542,800	5,708,500
CONSTRUCTION OF FACILITIES	113,700	97,500	150,500
RESEARCH AND PROGRAM MANAGEMENT	1,134,400	1,199,050	1,247,500
TOTAL	6,020,100	6,839,350	7,106,500
OUTLAYS	6,035,401	6,721,500	6,981,100

# Administrator's Column

In this column NASA Activities features an article by NASA
Administrator James M. Beggs. These articles focus on subjects
Administrator James M. Beggs. These articles focus on subjects
Administrator by him that address topics of broad interest to the agency's
Administrator Beggs on Feb. 3 before the Committee on Science and
Schnology, House of Representatives, concerning NASA's Fiscal
Year 1984 budget request.)

# MASA's Budget Request For Fiscal Year

It is a pleasure for me to appear before this distinguished Committee to present President Reagan's hadget request for NASA for Fiscal Year 1984. The local request is \$7.1 billion, of which \$5.7 billion is for esearch and development, \$150 million for construction of facilities, and \$1.25 billion for research and program management.

I am particularly proud to be at NASA in 1983 to relebrate its 25th Anniversary. During the 25 years since the United States entered the Space Age, our space program has grown from the 14-kg Explorer, bunched in January 1958, to a truly reusable Space Innsportation System.

I would like to begin by discussing some of the chievements of the past year—achievements which we been very significant, indeed, and which would not we been possible without the strong and continued support of the Congress. In 1982, the Space Shuttle whiter Columbia made three successful orbital flights d, during each flight, significant progress was made in inderstanding the operational features of the Shuttle system. This initial phase of the Space Transportation System flight program culminated with the first merational flight in November 1982, during which two commercial communications satellites were launched. there is no doubt in my mind that the investment this Nation has made in the Space Shuttle will pay off andsomely. We now know enough about the system it I can make this statement with great confidence.

A new Earth observation satellite, Landsat 4, was sheed in Earth orbit in July 1982, and its operations have been spectacularly successful. The satellite's new lematic mapper has provided information of a quality acceding the original specifications; it is providing shable information for the geophysical sciences as

well as excellent data for mapping and Earth resources assessment. Additionally, our Earth-orbiting scientific satellite and other spacecraft in the solar system have continued to operate and to return extremely valuable scientific information.

In aeronautics, the Department of Defense has recognized the importance of NASA's technical contributions by considering NASA's tilt-rotor aircraft concept as a prime contender for the new joint service JVX vertical take-off and landing aircraft program. The XV-15 experimental aircraft, jointly developed by the Army and NASA, served as the proof-of-concept vehicle which made this recognition possible. Two large new aeronautical facilities are nearing completion, the National Transonic Facility at Langley Research Center and the new  $80 \times 120$  foot addition to the  $40 \times 80$ foot Subsonic Wind Tunnel at Ames Research Center. The completion of operational test and checkout of the new 80 × 120 foot leg has recently suffered a set-back because of an accident during testing. The facility is expected to be operational in about two years. NASA hopes to repair the facility and return it to operation as soon as possible to minimize delays to a number of priority NASA, Department of Defense and industry testing programs.

I would now like to turn to another achievement, a renewed commitment to the American space program from the highest levels of this Administration. On July 4, 1982, President Reagan issued a policy statement which outlines basic U.S. goals for activities in space. These goals are:

- to strengthen the security of the United States;
- to maintain United States space leadership;
- to obtain economical and scientific benefits through the exploration of space;
- to expand United States private sector investment and involvement in civil and space related activities;
- to promote international cooperative activities in the national interest; and, finally,
- to cooperate with other nations in maintaining freedom of space for activities which enhance the security and welfare of mankind.

The NASA budget request for Fiscal Year 1984 is designed to achieve the objectives outlined in President Reagan's space policy—especially the maintenance of United States leadership in space. This is really the important word—leadership—and this Committee may rest assured that the Administration is strongly committed to what that word represents.

The key to leadership in space is to have efficient and effective ways of getting there. The President's space

policy strongly supports the Space Shuttle program, and calls the Shuttle "the primary space launch system for both United States national security and civil government missions."

NASA's proposed Fiscal Year 1984 budget fully supports a four-orbiter fleet, with enough structural and subsystem spares to make certain that the fleet is able to survive serious delays or accidents. Our proposal will also reduce the lead time for expansion or replacement of the four-orbiter fleet, if and when operational demands require. Our plans make it possible to meet the commitment to launch the payloads which we, and those depending upon us, have planned for at least the remainder of this decade. NASA's first priority remains: to make the Space Shuttle system fully operational as rapidly as possible. Additionally, we will continue to explore new ways of employing the full capability of the Shuttle. The proposed Fiscal Year 1984 request continues funding of activities leading to a Shuttle mission to recover and repair on orbit the partially defunct Solar Maximum Mission (SMM) spacecraft in 1984. This will provide more useful life for the important Solar Max objectives and demonstrate the Shuttle's ability to perform such operations. Later on this year, we are scheduled to fly the first Spacelab mission which is an important demonstration of the new capabilities represented by the Space Shuttle. Spacelab, developed and contributed by the European Space Agency, represents an important international activity consistent with the President's space policy. Another international contribution to the Space Shuttle program is the Remote Manipulator System which was provided

by the government of Canada. The System successfully completed testing last year and in November was declared ready for operational use aboard future Shuttle flights.

NASA policy has recently been revised to expand opportunities for sponsors of Shuttle payloads to nominate payload specialists to fly with them. President Reagan invited a Brazilian payload specialist to fly aboard the Shuttle, and during his recent discussions with the Prime Minister of Japan, he extended a similar offer which was accepted. Australia and Canada have also accepted invitations for payload specialist nominations.

The second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE '82), held in Vienna last August, helped to promote greater international awareness of the practical benefits of the applications of space science and technology.

In my testimony before this Committee last year, I said that the Space Telescope will be the most important scientific instrument we have ever flown. I continue to believe this is true, and NASA's Fiscal Year 1984 budget request provides priority support to this very important development effort.

As might be expected in a program of this complexity, we are continuing to experience technical problems, particularly in the Optical Telescope Assembly development activities, which will most likely impact the scheduled launch and runout cost of the

#### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

### BUDGET SUMMARY

# BUDGET PLAN (Thousands of Dollars)

BUDGET PLAN	FY 1982	FY 1983	FY 1984
Research and development	4,771,950	5,542,800	5,708,500
Construction of facilities	113,700	97,500	150,500
Research and program management	1,134,134	1,199,050	1,247,500
TOTAL BUDGET PLAN	6,019,784	6,839,350	7,106,500
OUTLAYS	6,035,401	6,721,500	6,981,100

Space Telescope. We are currently reviewing a range of alternatives for rephasing the work to minimize the cost and schedule impact. As soon as our evaluation is complete, we will inform the Committee of our proposed actions.

Excellent progress is being made in other areas related to the Space Telescope. In a few months, we will open the doors of the new Space Telescope Science Institute which has been established at the Johns Hopkins University. Software and procedures for carrying out scientific investigations with this very complex space observatory are on schedule. The Space Telescope will open a new era of scientific opportunity and permit the United States to retain world leadership in astronomy.

Another measure of leadership in space is the continuing enterprise of planetary exploration. We have included in the proposed Fiscal Year 1984 budget the initiation of a new program to map the surface of the planet Venus using radar imaging techniques. Within our overall strategy for planetary exploration, this initiative, the Venus Radar Mapper, estimated to cost in the \$350 million range—replaces, at a much lower cost, the Venus Orbiting Imaging Radar mission authorized by the Congress to begin in Fiscal Year 1982. The Venus Radar Mapper Mission will help us understand why our sister planet, Venus, which is so much like the Earth in size and physical composition, yet so different in other respects, has followed such a different evolutionary history. We will search for detailed properties in common with the Earth, such as volcanic activity and continental drift. Aside from their intrinsic scientific value, observations provided by the Venus Radar Mapper will help us to understand more clearly the history, nature, and most importantly, the future of our own planet.

The Advanced Communications Technology Satellite (ACTS) project, another new initiative proposed in the FY 1984 budget, calls for development and flight testing of the high-risk technology needed to ensure continued United States preeminence in the field of satellite communications. The decision to propose the ACTS program is a result of extensive consultation with communication carriers, satellite system suppliers, and strong support from the Congress. The ACTS program will involve a novel procurement approach, including a cost/risk sharing arrangement with industry which will provide significant cost savings to the government.

Another goal of the President's space policy is to expand private sector investment and involvement in space activities. NASA has received proposals from the private sector to fund and/or operate launch vehicles.

We are reviewing these proposals very carefully to determine costs and benefits, launch and tracking requirements, safety and security, as well as international considerations.

In addition to the President's space policy which I have already discussed, the Administration has developed a new policy statement governing the needs for and management of federally-funded research and development work in aeronautics. In November 1982, the President's Office of Science and Technology Policy released a document entitled,"Aeronautical Research and Technology Policy." The aeronautics program included in NASA's Fiscal Year 1984 budget request reflects many recommendations contained in this important policy statement. The most important facet of the Administration's new aeronautics policy is the recognition that a strong aeronautical industry is absolutely essential for both the National security and the health of our economy. Furthermore, this policy recognizes explicitly the important role the federal government, through NASA, plays in providing the basic technology which will assist the United States in maintaining and enhancing the leadership position in aviation which we now enjoy. In concert with this policy, we are submitting a Fiscal Year 1984 budget request which continues to emphasize a strong aeronautical research and technology program, including a strengthened fundamental research program which will continue to provide the technical base upon which future aircraft designs can be based.

The centerpiece of our proposed aeronautics program for Fiscal Year 1984 is the new Numerical Aerodynamic Simulation (NAS) activity, which will be developed over the course of the next few years. The NAS capability will include a large computer system which will make it possible to perform most of the calculations required to design a new aircraft with sufficient accuracy and reliability to significantly reduce the long and expensive process of wind tunnel and flight testing now necessary. There is every reason to believe that the computer technology to achieve this objective can be developed in the next few years, and there is no question that the capability the NAS represents will make it possible to design new airplanes much more effectively. The investment made in NAS will provide incentives for various elements of the computer industry to produce machines which will be able to take advantage of major commercial applications. Developments of this kind will enhance the competitive posture of the United States in this important international market.

The Fiscal Year 1984 budget proposed by the Administration also contains a number of items which

are very important to the future of NASA's health as an institution. It is clear that the achievements I have outlined earlier in my testimony would not have been possible without a strong NASA institution. In the Fiscal Year 1984 budget before you, there is a substantial increase in funding for construction of facilities - \$150 million as compared to approximately \$100 million in Fiscal Year 1983. We also are proposing the maintenance of the same number of civil service positions in Fiscal Year 1984 as we have in Fiscal Year 1983. The maintenance of our civil service strength is particularly significant because this manpower level will afford an opportunity for NASA to hire some of the best recent graduates of the foremost science and engineering schools in the Nation. We plan to take aggressive steps to bring in the best people we can find in order to stengthen NASA's institution for the long term.

In the past year concern has been expressed in the press and in the Congress about the appropriate relationship between NASA and those elements of the National security establishment with responsibility for space operations. I would like to take this opportunity to state categorically that this Administration is strongly committed to separate space programs, one dealing with civil sector operations and the other with those related to the National security. The President's space policy is very clear on this point, stating that, "The United States space program will be comprised of two separate, distinct, and strongly interacting programs—National security and civil. Close coordination, cooperation, and information exchange will be maintained among these programs to avoid unnecessary duplication." We have continued to maintain separate programs and to have separate policies governing these programs; but we have also developed a number of new interactive relationships which promote efficient coordination and management while protecting the integrity of NASA programs. We have just finalized a renegotiated Shuttle pricing agreement with the Department of Defense. This new agreement will provide NASA with increased reimbursements of approximately \$1 billion more in the next five years than the agency would have received under the previous policy agreed to in 1977. This revised policy will raise the Shuttle launch cost to the Department of Defense by almost 150 percent, in Fiscal Year 1975 dollars, above the previously set launch price. We also have several Memoranda of Understanding with the Department of Defense which deal with various aspects of programs in order to avoid the unnecessary duplication which the President mentions in his space policy.

I would be remiss if I did not conclude this portion of my testimony by talking about the future. The President's space policy recognizes the importance of developing new concepts which provide a strong vision of the future, not only for our space program, but for the Nation as a whole. In his space policy, the Presiden requires NASA to "continue to explore the requirements, operational concepts, and technology associated with permanent space facilities." The Space Shuttle makes it easier to establish larger permanent facilities in space. NASA's proposed Fiscal Year 1984 budget includes modest funding for definition and planning efforts which will allow us to understand, in greater detail, how such permanent facilities might be developed and maintained in Earth orbit. These studies will provide a basis for considering possible future proposals to establish a permanent manned station in Earth orbit.

# RESEARCH AND DEVELOPMENT PROGRAMS BUDGET PLAN (Thousands of Dollars)

	FY 1982	FY 1983	FY 1984
SPACE TRANSPORTATION SYSTEMS	3,089,850	3,597,800	3,498,000
Space transportation capability			
development	2,623,350	2,144,100	1,927,400
Space transportation operations	466,500	1,453,700	1,370,600
SPACE SCIENCE AND APPLICATIONS	896,200	1,034,100	1,068,000
Physics and astronomy	322,433	441,000	514,608
Planetary exploration	210,000	186,400	205,400
Life sciences	39,500	55,700	59,060
Solid earth observations	149,400	132,200	74,4碘
Environmental observations	133,023	156,900	163,000
Materials processing in space	16,244	22,000	21,600
Communications	21,300	32,400	21,100
Information systems	4,300	7,500	8,900
TECHNOLOGY UTILIZATION	8,000	9,000	4,000
AERONAUTICS AND SPACE TECHNOLOGY	375,800	403,000	438,300
Aeronautical research and technology	264,800	280,000	300,369
Space research and technology	111,000	123,000	138,000
TRACKING AND DATA ACQUISTION	402,100	498,900	700,200
TOTAL	4,771,950	5,542,800	5,706,500

# OFFICE OF SPACE TRANSPORTATION SYSTEMS BUDGET PLAN (Thousands of Dollars)

	PY 1982	FY 1983	PT 1964
SPACE TRANSPORTATION CAPABILITY DEVEVELOPMENT SHUTTLE PRODUCTION AND CAPABILITY DEVELOPMENT.	2,623,350 2,176,750	2,144,100 1,729,300	1,927,400
UPPER STAGES	106,700	167,000	143,260
SPACELAB	100,800	121,200	119,400
ENGINEERING AND TECHNICAL BASE	183,100	70,300	95,100
PAYLOAD OPERATIONS AND SUPPORT EQUIPMENT	46,300	44,400	53,200
ADVANCED PROGRAMS	9,700	11,900	15,000
TETHERED SATELLITE SYSTEM			1,300
SPACE TRANSPORTATION OPERATIONS SHUTTLE OPERATIONS	466,500 435,300	1,453,700 1,370,700	1,570,660
EXPENDABLE LAUNCH VEHICLES	31,200	83,000	50,000

#### AERONAUTICS AND SPACE TECHNOLOGY

## RUDGET PLAN

Facility Planning and Design.....

oursement to GSA For NASA Utilized Property at Ellington

Air Force Base, Texas, As Directed by ONB.....

TOTAL....

Subtotal.....

(Thousands of Dollars) FY 1982 FY 1983 FY 1984 FY 1982 FY 1983 FY 1984 HUSICS AND ASTRONOMY

SPACE TELESCOPE DEVELOPMENT. 322,433 137,500 120,600 AERONAUTICAL RESEARCH AND TECHNOLOGY RESEARCH AND TECHNOLOGY BASE..... 264,800 (172,758) 280,000 (197,700) 300,300 (227,800) MOMA RAY OBSERVATORY DEVELOPMENT..... 8.000 34.500 89.800 SYSTEMS TECHNOLOGY PROGRAMS..... (92 042) (82 300) (72 500) Rotorcraft Systems Technology...... 27,600 SEUTTLE/SPACELAR PAYLOAD DEVELOPMENT AND MISSION MANAGEMENT.... 47.556 83.000 92.900 High-Performance Aircraft Systems and Technology..... 13.800 15.000 19.900 EXPLORER DEVELOPMENT..... 33,300 34.300 48.700 Subsonic Aircraft Systems Technology .... 27 022 17 000 5 000 MISSION OPERATIONS AND DATA ANALYSIS..... 45 300 74 800 79.500 Advanced Propulsion Systems Technology... 26, 155 28,000 MISEARCH AND ANALYSIS..... 22.935 28 800 29.800 20.000 Numerical Aerodynamic Simulation..... SUBORBITAL PROGRAM..... 43 842 48.100 53, 300 Other Systems Technology ...... 3,400 91 600 205,400 SPACE RESEARCH AND TECHNOLOGY
RESEARCH AND TECHNOLOGY BASE...... 138,000 (126,200) (111,000 (104,646) 123,000 (115,100) VENUS RADAR MAPPER MISSION..... 29.000 SYSTEMS TECHNOLOGY PROGRAMS..... (3.354) (4.900) (7.200) INTERNATIONAL SOLAR POLAR MISSION..... 8,000 5 000 6.000 5,500 Space flight experiments..... 1,054 Long duration exposure facility..... 1.560 2 100 700 MISSION OPERATIONS & DATA ANALYSIS..... 42.600 38, 500 43 400 Ion auxiliary propulation system...... 1,000 RESEARCH AND ANALYSIS..... 46.700 50.300 45,500 STANDARDS AND PRACTICES..... (3,000) (3,000) (4,600) LIFE SCIENCES 39,500 55,700 59,000 MANUELLE EARTH OBSERVATIONS 81,900 SPACE THACKING AND DATA SYSTEMS 132,200 74,400 TRACKING AND DATA ACQUISITION
SPACE NETWORK......
Tracking and data relay satellite (103.800) 700,200 (294,700) EXTENDED MISSION OPERATIONS..... (21 BOO) 2.800 1.800 1.006 SHUTTLE/SPACELAB PAYLOADS..... 12.300 13,800 15,000 system.....Other space network..... 51.300 242.900 51,800 21.800 GZODYNAMICS.... 22 900 26.200 28,000 GROUND NETWORK..... (237.457) (242.400) (231.500) ADRISTARS.... 14 000 15,000 COMMUNICATIONS AND DATA SYSTEMS..... (139.300) (159.800) (130.343) MESEARCH AND ANALYSIS..... 15 500 13.700 14.600 ADVANCED SYSTEMS............. (12,500) (14.200) (13,400)WINDONNENTAL OBSERVATIONS 133,023 156,900 27,700 HER ATMOSPHERE RESEARCH AND ANALYSIS.... PISCAL YEAR 1984 CONSTRUCTION OF PACILITIES PROGRAM ATMOSPHERIC DYNAMICS AND RADIATION 22.300 26,500 28,400 BUDGET PLAN (Thousands of Dollars) CEANIC PROCESSES RESEARCH AND ANALYSIS ... 16.900 17,000 18.200 PROJECTS BY INSTALLATION SPACE PHYSICS/ATD RESEARCH & ANALYSIS 12 123 15,200 15,700 UTTLE/SFACELAB PAYLOAD DEVELOPMENT..... Jet Propulsion Laboratory

Construction of frequency standards laboratory. 4.100 3.700 7.600 Construction of frequency standards laboratory.

Modification to space flight operations facility....... WERATIONAL SATELLITE IMPROVEMENT PROGRAM. 6.000 6.000 600 1 600 MARTH RADIATION BUDGET EXPERIMENT..... 24.000 24,000 Ames Research Center
Construction of fluid mechanics laboratory..... 3,900 EXTENDED MISSION OPERATIONS..... 16.100 22.800 27,400 Hugh L. Dryden Flight Research Facility
Construction of aeronautical tracking facility...... MPER ATMOSPHERE RESEARCH SATELLITE EXPERIMENTS AND MISSION DEFINITION..... 6 000 14.000 20,000 MALOGEN OCCULTATION EXPERIMENT...... Langley Research Center
Modifications and addition for composite materials laboratory 5.000 9,500 MARIALS PROCESSING IN SPACE (1293A)..... 16,244 22,000 21,600 5,100 4,400 CHOUNICATIONS 32,400 21,300 21,100 Lewis Research Center
Modifications for small engine component testing facility...... 7,000 MORNATION SYSTEMS 4,300 7,500 8,900 Modifications to icing research tunnel..... 3.600 Space Shuttle Facilities at Various Locations as Follows: Modifications for additional chillers for mission control 41,300 TECHNOLOGY HTTLLTATION 2 300 TICHNOLOGY UILIZATION 8,000 9,000 4,000 27.300 11,700 Space Shuttle Payload Facilities at Various Locations as Follows: Construction of cargo hazardous servicing facility (KSC)...... 9,000 Modifications to spacecraft assembly and encapsulation facility (SAEF-2) for cargo processing..... RESEARCH AND PROGRAM MANAGEMENT 3,000 Various Locations Relocation of 26-meter STDN Antenna, Spain (JPL)......  $\frac{1,700}{1,700}$ BUDGET PLAN (Thousands of Dollars) of Facilities at Various Locations, Not in Excess of \$500,000 per Project.... 19,500 INSTALLATION FY 1982 FY 1983 FY 1984 son Space Center........ 186,569 195,193 204,616 Minor Construction of New Facilities and additions to Existing Facilities at Various Locations, Not in Excess of \$250,000 Space Center..... 155,958 163.341 173,472 Arshall Space Flight Center ..... 172,059 183,952 per Project..... 4,800

186,663

9,302 183,726

108,835

139,081

121,857

119,948

1,247,500

6,332 180,865 107,374

134,189

115,920

111.884

1,199,050

6,604 169,132

101,054

126,591

106,412

109.755

1,134,134

Ational Space Technology Laboratories ..

Midderd Space Flight Center......

engley Research Center.....

M4 Headquarters.....

10TAL....

ts Research Center..........

9,200

142,100

8,400

150,500